A
SEMINAR REPORT
ON
SCREENLESS DISPLAY



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CANDIDATE'S DECLARATION

I hereby certify that work which is being presented in the seminar report entitled **"SCREENLESS DISPLAY"** by **"ASHISH KUMAR ANAND"** in partial fulfillment of requirements for the award of degree of **B.Tech.-CSE(3rd year)** submitted in the Department of Computer Science at **Jaipur National University, Jaipur** is an authentic record of my own work carried out.

Signature of the Student

The **B.Tech -CSE (3rd year)** seminar presentation of ASHISH KUMAR ANAND has been accepted.

Signature of Internal Examiner 1

Signature of External Examiner

Signature of Internal Examiner 2

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INTRODUCTION

1. INTRODUCTION

Technology is making a huge modification in existing machines or tools in order to solve problem at higher level and make life comfortable. Screen less display is one of the most interesting subjects in technologies and research on this is increasing by exponential scale day by day. It is a system of transferring information/data though an electronic video source without using screen at all. Few parts of this technology is being used at present but they are not so advance yet. Screenless display is the present evolving technology in the field of the computer-enhanced technologies. It is going to be the one of the greatest technological development in the coming future years. Several patents are still working on this new emerging technology which can change the whole spectacular view of the screenless displays. Screen less display technology has the main aim of displaying (or) transmitting the information without any help of the screen (or) the projector. Screen less displays have become a new rage of development for the next GEN-X. Screenless videos describe systems for transmitting visual information from a video source without the use of the screen.

Well screenless display, AKA hologram, has such amazing potential that my hope is that the internet can be a medium for collaboration of ideas and information about screenless display that could help break down the barriers that prevent us from making it a reality. Essentially screenless display is a projection that can be seen projected onto the air itself. The only screenless display that has been achieved to my knowledge still uses fog as a medium to reflect light. Other options have been to use mirrors and plastic film to imitate the idea, but no one has been able to reflect light off of air itself. Can it be done? It's quite possible that it can. Light does reflect off of large amounts of air as we see in our atmosphere but doing it in such a manner that we could pinpoint it to a single area is immensely difficult. So why not take some time and look over some ideas I have collected about the possibilities of screenless display and maybe even share some of your own. Check some of the links below to get a better grasp on the development of the technology.

1.1 The Basic System

In the past similar systems have been made by projecting a defocused image directly in front of the user's eye on a small "screen", normally in the form of large glasses. The user focused their eyes on the background, where the screen appeared to be floating. The disadvantage of these systems was the limited area covered by the "screen", the high weight of the small televisions used to project the display, and the fact that the image would appear focused only if the user was

focusing at a particular "depth". Limited brightness made them useful only in indoor settings as well.

Only recently a number of developments have made a true VRD system practical. In particular the development of high-brightness LEDs have made the displays bright enough to be used during the day, and adaptive optics have allowed systems to dynamically correct for irregularities in the eye (although this is not always needed). The result is a high-resolution screenless display with excellent color gamut and brightness, far better than the best television technologies.

In a conventional display a real image is produced. The real image is either viewed directly or, as in the case with most head-mounted displays, projected through an optical system and the resulting virtual image is viewed. The projection moves the virtual image to a distance that allows the eye to focus comfortably. No real image is ever produced with the VRD. Rather, an image is formed directly on the retina of the user's eye.

Fig 1. Basic Display

1.2 History Behind Screenless Display

Reto Meier, an “Android Developer Advocate for Google” recently laid out a fairly science-fiction account of where computer (or at least mobile) interfaces are headed.

In the spirit of the best futurism, all of his predictions - from Augmented Reality eye glasses to advanced batteries - have parallels in the real world. What follows is a walk-through of the future, expressed in terms of the not quite ready for prime time discoveries coming out of labs today.

Working on the average laptop is like working on a desk that’s as big as a sheet of paper. That’s why all our “files” are half an inch high. The key to productivity and immersion is more, bigger screens - hence the proliferation of external monitors, secondary reading devices and even mobile phones with improbably large screens.

So-called “Pico” projectors (named for their tiny size) already exist - there’s even an HD version, the Forever Plus, that’s less than an inch on its longest dimension. And there are mobile phones, such as the Samsung Show, which have built-in picoprojectors - so outside of market demand (how many of us really need this?) there’s nothing to stop this prediction from coming true.

1.3 Technology used in Screenless Display

1.3.1. Interactive Projection and Visual Display System

The biggest impact in screenless technology has been seen in the use of optical technology. Whether talking of VRD (virtual retinal display), RSD (retinal scanning display) or LOE (light-guide optical element), optical technology is being used by consumer electronic corporations like Apple to the military and even the health care industry. Optical technology enables personal screenless displays by projecting images and data from computers, DVD players, or VCRs into the viewer's eye, displaying them in the visual field of the viewer. For instance, Microvision Inc. has created helmet mounted displays in which an Army tank commander can view the surrounding area from topside while still viewing a translucent map that floats a couple of feet away.

Fig 2. Interactive projection

1.3.2. 3D Display Projection Technology

With the large influx of new displays into the market boasting '3D support', we thought we would produce an article which outlines some of the key technologies being used, where they differ and how they work. We will look at the two main techniques being used today, those being active shutter and passive polarization technologies. We will also discuss the trends in desktop displays from a 3D point of view as well as looking at the other aspects being developed to support 3D, such as panel technology.

To begin with an explanation, a modern 3D display / monitor is capable of conveying a stereoscopic perception of 3D depth to the viewer. The basic requirement is to present offset images that are displayed separately to the left and right eye. Both of these 2D offset images are then combined in the brain to give the perception of 3D depth. Although the term "3D" is ubiquitously used, it is important to note that the presentation of dual 2D images is distinctly different from displaying an image in 3 full dimensions. The most notable difference is that the observer is lacking any freedom of head movement and freedom to increase information about the 3-dimensional objects being displayed. Holographic displays do not have this limitation, so the term "3D display" fits accurately for such technology. In modern displays the term 3D is actually an overstatement of capability and is referring to dual 2D images as being "3D". The accurate term "stereoscopic" is more cumbersome than the common misnomer "3D", which has been entrenched after many decades of unquestioned misuse.

It is generally expected that most consumers have the desire to migrate to 3D systems from 2D. It is predicted that the 3D market will grow tremendously as soon as the problems in the existing products are eliminated and the issues on basic infrastructure, such as price competitiveness and 3D content, will be resolved. It is highly likely that the content industry will also make a fast transition into 3D in all areas such as TV, film, and game and have already begun to make this change.

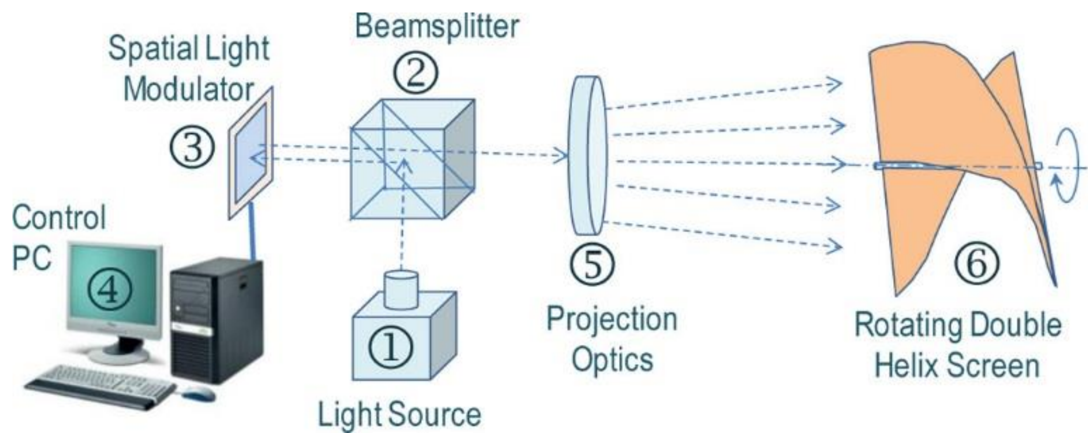


Fig 3. 3D projection

The Bees Knees

Screenless display is the emerging display technology. In these examples you see that the user is able to interact with a three dimensional image projected into thin air. Imagine your desktop floating in the space before your eyes waiting for your interaction.

Screenless display technology is likely to affect:

1. Lighting and projection technologies
2. Software development/design
3. Lifestyles of the visually impaired
4. Career opportunities for the visually impaired

Screen less computing systems can be divided mainly into 3 groups:

1. Visual image
2. Retinal direct
3. Synaptic interface

2. BACKGROUND

The first screen-less display that needs mentioning is Google Glass. This device has been tested for the past year, and some lucky individuals have even got their devices already. Google Glass sits on the face like a pair of glasses, and on one eye it has a block of glass that allows you to see augmented reality. Images can be displayed right in front of your eye, as well as text and information about objects and places that are in front of you. This technology is only in its early stages, but definitely shows that screen-less displays will become a natural form of media consumption in the future.

2.1. VISUAL IMAGE

Visual Image screen less display includes any screen less image that the eye can perceive. The most common example of Visual Image screen less display is a hologram.

Holographic messages, which we previously saw only in movies like Star Wars are about to become reality through a new technology arrived directly from Japan. It's True 3D, which is based on older technology, developed by AIST and Keio University in 2006. This new projection system can be used to present images without the need for a screen.

The system works by focusing a laser beam that generates a plasma environment from the oxygen and nitrogen present in air, thus enabling it to display holographic images. According Ubergizmo.com, the projected holographic images appear as 3D floating objects in mid-air.

At this point, the system creates approximately 50,000 points per second and features a frame rate of 10-15 FPS, but Japanese scientists are trying to increase it to 24-30 FPS. So far, the images are only monochromatic (single color), green, but multi-colored images but can also be created using lasers emitting at different wavelengths e.g. blue and red.

Fig 5. Visual display

HOLOGRAM

Holograms were used mostly in telecommunications as an alternative to screens. Holograms could be transmitted directly, or they could be stored in various storage devices (such as holodiscs) the storage device can be hooked up with a holoprojector in order for the stored image to be accelerated.

Debatably, virtual reality goggles (which consist of two small screens but are nonetheless sufficiently different from traditional computer screens to be considered screen less) and heads-up display in jet fighters (which display images on the clear cockpit window) also are included in Visual Image category. In all of these cases, light is reflected off some intermediate object (hologram, LCD panel, or cockpit window) before it reaches the retina. In the case of LCD panels the light is refracted from the back of the panel, but is nonetheless a reflected source [3]. The new software and hardware will enable the user to, in effect; make design adjustments in the system to fit his or her particular needs, capabilities, and preferences. They will enable the system to do such things as adjusting to users' behaviors in dealing with interactive movable type.



Fig 7. Hologram Display

Holographic technology has unfortunately not gone very far past trickery with mirrors. This form of photography provides a three dimensional image, and some technologies are now creating images using lenses, helium neon and holographic film. Scientists will not have a fully working holographic table prepared for market any time soon, but it is definitely on the cards for the future. The only downfall of this kind of system, however, is that the orientation and viewing angle of a viewer will determine the quality of the image that can be seen – meaning that so far, holographs are not ideal for media or information consumption.

Holographs can work by using a laser beam that can interfere with an object beam. When these two beams get in the way of one another, they can create what looks like a three dimensional image. This image can then be recorded for processing by recording the diffraction of the light and the way in which the beams interfere with one another.

2.2. RETINAL DISPLAY

Virtual retinal display systems are a class of screen less displays in which images are projected directly onto the retina as shown in figure 3. They are distinguished from visual image systems because light is not reflected from some intermediate object onto the retina; it is instead projected directly onto the retina. Retinal Direct systems, once marketed, hold out the promise of extreme privacy when computing work is done in public places because most inquiring relies on

viewing the same light as the person who is legitimately viewing the screen, and retinal direct systems send light only into the pupils of their intended viewer.

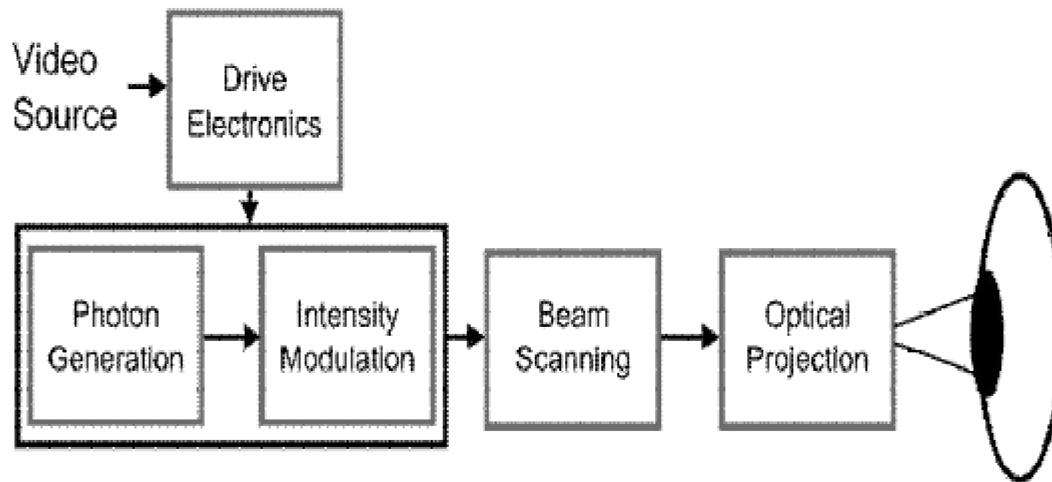


Fig 8. Block diagram of Retinal Display

With a retinal display light is not reflected off an immediate object, like in a visual image, but it is projected directly onto the retina. This can be handy in that one is not limited by physical screen size because there is no immediate object to be viewed, retinal display can be used to keep things such as financial information safe from snooping eyes. The image can take up the entire field of vision. We've seen the potential of retinal displays in movies like Terminator.

2.3 SYNAPTIC INTERFACE

Synaptic Interface screen less video does not use light at all. Visual information completely bypasses the eye and is transmitted directly to the brain. While such systems have yet to be implemented in humans, success has been achieved in sampling usable video signals from the biological eyes of a living horseshoe crab through their optic nerves, and in sending video signals from electronic cameras into the creatures' brains using the same method.

Brain–computer interface

A brain–computer interface (BCI), often called a mind-machine interface (MMI), or sometimes called a direct neural interface (DNI), synthetic telepathy interface (STI) or a brain–machine interface (BMI), is a direct communication pathway between the brain and an external device. BCIs are often directed at assisting, augmenting, or repairing human cognitive or sensory-motor functions.
Research on BCIs began in the 1970s at the University of California Los Angeles (UCLA) under a grant from the National Science Foundation, followed by a contract from DARPA. The papers

published after this research also mark the first appearance of the expression brain–computer interface in scientific literature.
The field of BCI research and development has since focused primarily on neuroprosthetics applications that aim at restoring damaged hearing, sight and movement. Thanks to the remarkable cortical plasticity of the brain, signals from implanted prostheses can, after adaptation, be handled by the brain like natural sensor or effector channels.[3] Following years of animal experimentation, the first neuroprosthetic devices implanted in humans appeared in the mid-1990s.

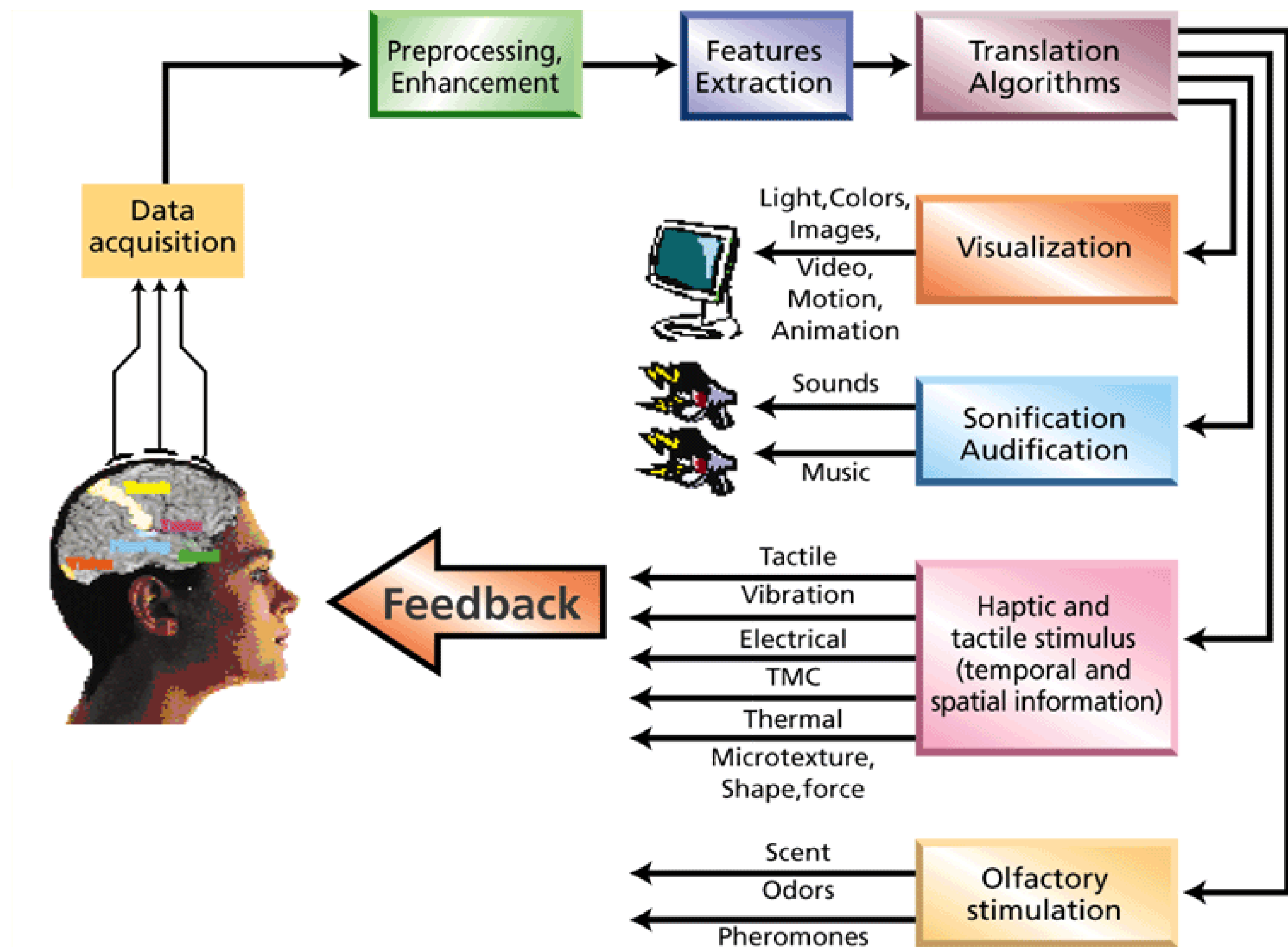


Fig. 12. Brain-computer interface

The most profound effect will come from the development of the synaptic interface technology. This technology will allow people who are visually impaired to see just as the hearing impaired are able to hear through cochlear implants. Imagine a visually impaired person gaining the freedom to drive again! This will also remove occupational limitations of the visually impaired.

The ability to control a computer using only the power of the mind is closer than one might think. Brain-computer interfaces, where computers can read and interpret signals directly from the brain, have already achieved clinical success in allowing quadriplegics, those suffering

“locked-in syndrome” or people who have had a stroke to move their own wheelchairs or even drink coffee from a cup by controlling the action of a robotic arm with their brain waves. In addition, direct brain implants have helped restore partial vision to people who have lost their sight.

Recent research has focused on the possibility of using brain-computer interfaces to connect different brains together directly. Researchers at Duke University last year reported successfully connecting the brains of two mice over the Internet (into what was termed a “brain net”) where mice in different countries were able to cooperate to perform simple tasks to generate a reward. Also in 2013, scientists at Harvard University reported that they were able to establish a functional link between the brains of a rat and a human with a non-invasive, computer-to-brain interface.

3. THE WORKING PRINCIPLE

There are several new emerging ways for the technological development of the working principle of the screen less displays. Several software’s are merging for the GEN-X wonder view. Any computer system that can run the mudoc software can present text that has been set in interactive movable type. Most of the mudocs that are consumed in the next few years will be consumed with conventional personal computers, e-book readers, and other kinds of display and projection devices that are now in use. Very soon it appears to be a new kind of input/output system will facilitate communication and interaction between the computer and the computer user. This new human/computer interface is the telereader terminal. Visual Image is a bitmap manipulation and composition product. Bitmaps can be manipulated independently, in the Image Mode or multiple bitmaps can be composited Together in the Object Mode to create a "collage". Visual Image can create and Manipulate images of any size: the only limitation is the amount of memory resources your system has.

A. Creating Visual Catalog Files with Visual Image Visual Image gives you the ability to create files in the EYE file format for use in the Visual Catalog program. These EYE files can be used to create catalogs of images in logical sub groupings: for example, you can create a catalog file in the
EYE format that lists all images of building materials (brick, concrete, stone, etc.). The File, Export Project command creates an EYE file that refers to all of the images that are currently loaded into Visual Image. When you select this command, you are prompted to enter a filename for the EYE file that is to be created. If you have created any image in Visual Image that are not yet saved to disk you will be asked if you wish to include those images in the EYE file and if so, you are prompted to store those images as bitmaps. The File, Exports Editor Command in Visual Image allows you to pack and choose those image files on disk that you wish to include in a catalog EYE file. When you select File in Export Editor, a file browser appears from which you can choose the image files to include. Use this browser to select images to add to a project file for use in Visual Catalog

3.1 How Vision works

In Screenless display images projecting directly onto a person's retina, not only avoiding the need for weighty hardware, but also promising to safeguard privacy by allowing people to interact with computers without others sharing the same view. By January 2014, one start-up company had already raised a substantial sum via Kick starter with the aim of commercializing a personal gaming and cinema device using retinal display. In the longer term, technology may allow synaptic interfaces that bypass the eye altogether, transmitting "visual" information directly to the brain.

We can see things because of reflected light. Light bounces of an object and enters our eye. This light then focuses on the retina to form an image.

3.2 Additional Software and Hardware Requirements

1. To facilitate the interactivity.

2. To optimize the user's perceptual and cognitive capabilities.

3. To provide the most healthful visual environment for the user.

4. Responding to a variety of user commands (using voice, hand, foot, or other signal methods).

5. Providing blink cues or blinks responses.

6. Modifying output to compensate for changes in user's physiology or reaction time, etc. The new software and hardware will enable the user and the system to better exploit each other's capabilities and to function as a fully integrated team.

4. VIRTUAL RETINAL DISPLAY STRUCTURE AND IMPLEMENTATION

A virtual retinal display (VRD), also known as a retinal scan display (RSD), is a new display technology that draws a raster display (like a television) directly onto the retina of the eye. The user sees what appears to be a conventional display floating in space in front of them. Similar systems have been made by projecting a defocused image directly in front of the user's eye on a small "screen", normally in the form of large sunglasses. The user focuses their eyes on the background, where the screen appeared to be floating. The disadvantage of these systems was the limited area covered by the "screen", the high weight of the small televisions used to project the display, and the fact that the image would appear focused only if the user was focusing at a particular "depth". Limited brightness made them useful only in indoor settings as well. Only recently, a number of developments have made a true VRD system in practice. In particular, the development of high-brightness LEDs have made the displays bright enough to be used during the day and adaptive optics have allowed systems to dynamically correct for irregularities in the eye (although this is not at all needed in all situations). The result is a high-resolution screen less

display with excellent color range and brightness, far better than the best television technologies. The VRD was invented at the University of Washington in the Human Interface Technology Lab in 1991. Most of this research into VRDs to date has been in combination with various virtual reality systems. In this role VRDs have the potential advantage of being much smaller than existing television-based systems. They share some of the same disadvantages however, requiring some sort of optics to send the image into the eye, typically similar to the sunglasses system used with previous technologies. It can be also used as part of a wearable computer system. More recently, there has been some interest in VRDs as a display system for portable devices such as cell phones, PDAs and various media players. In this role the device would be placed in front of the user, perhaps on a desk, and aimed in the general direction of the eyes. The system would then detect the eye using facial scanning techniques and keep the image in place using motion compensation. In this role the VRD offers unique advantages, being able to replicate a full sized monitor on a small device. The most recent innovations in mobile computing have been based around touch screen technology [6]. The future of mobile devices is both touch less and screen less. By 2020 the mobile phone as we know it today will disappear and something very different will take its place. Instead of touching a screen, we will interact with technology directly through our senses, through technology embedded in what he is calling "Internet Glasses". Voice was always organized in sessions with a beginning and an end. Today we have threads, i.e. when a thread is started it never ends and we have many continuing in parallel. Think of your email, RSS feeds, Twitter, etc. So this is how our brain works. The hone of tomorrow will be telecoupling and related machines and future is bypassing screens and keyboards altogether as in figure 6. The two key technologies will be laser based displays, which display images directly onto our retinas and brain wave sensing implants as shown in figure 5. This will allow technology to integrate with our 'reality vision' much more seamlessly. We are on the verge of a hardware revolution that will make this all possible, as well as the cloud-based information streaming that will enable the user interface to become a reality.

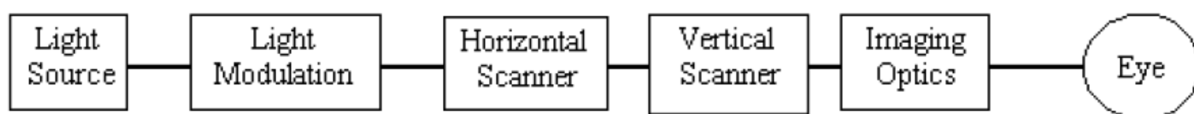


Fig. 14. Basic block diagram of the Virtual Retinal Display.

The Virtual Retinal Display (VRD) is a unique approach to developing a high-resolution head-mounted display currently under development at the University of Washington's Human Interface Technology (HIT) Laboratory. Rather than looking at a screen though a magnifier or optical relay system, the viewer of the VRD has a scanned beam of light enter the pupil of the eye and focused to a spot on the retina. This type of optical system is subject to different design constraints than a typical HMD. With the VRD it may be possible to realize higher resolution,

greater color saturation, higher brightness and larger field-of-view than a traditional LCD or CRT screen-based system.

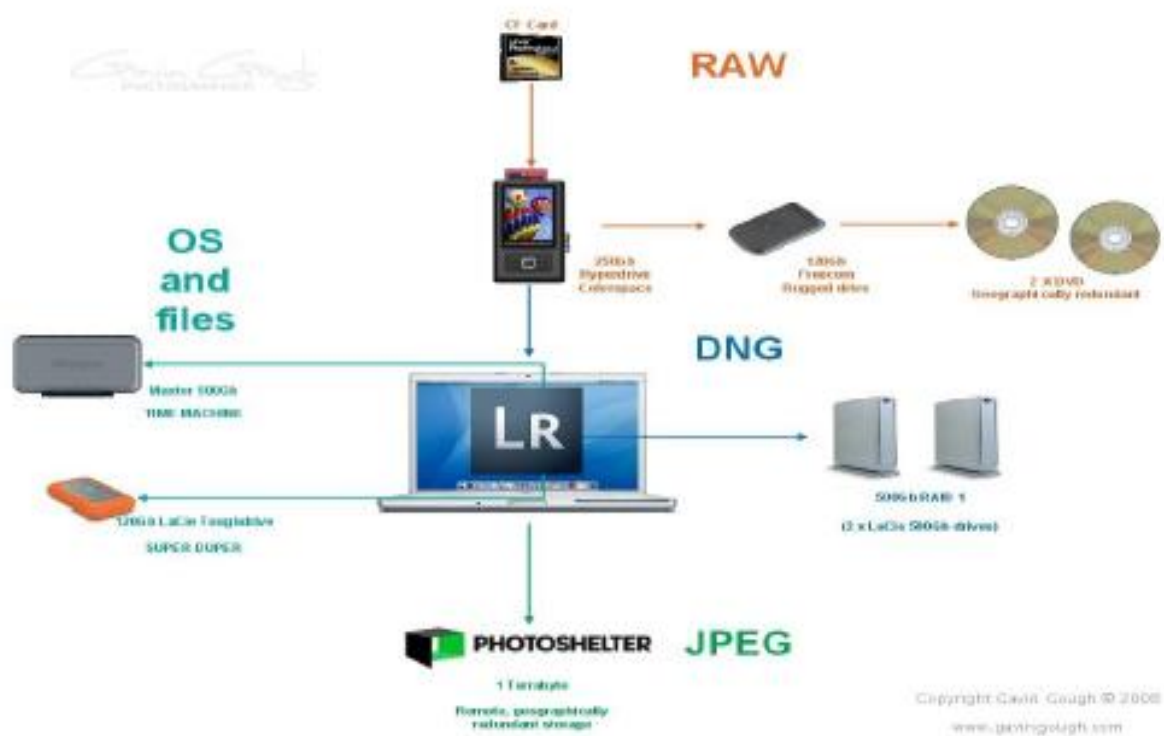


Fig. 16. System Architecture

4.1 Background Of The Invention

This invention relates to retinal display devices, and more particularly to a method and apparatus for mapping and tracking a viewer's eye.

A retinal display device is an optical device for generating an image upon the retina of an eye. Light is emitted from a light source, collimated through a lens, then passed through a scanning device. The scanning device defines a scanning pattern for the light. The scanned light converges to focus points on an intermediate image plane. As the scanning occurs the focus point moves along the image plane (e.g., in a raster scanning pattern). The light then diverges beyond the plane. An eyepiece is positioned along the light path beyond the intermediate image plane at some desired focal length. An “exit pupil” occurs shortly beyond the eyepiece in an area where a viewer's eye pupil is to be positioned.

A viewer looks into the eyepiece to view an image. The eyepiece receives light that is being deflected along a raster pattern. Modulation of the light during the scanning cycle determines the content of the image. For a see-through virtual retinal display a user sees the real world environment around the user, plus the added image of the display projected onto the retina.

4.2 Working Of Virtual Retinal Display

A viewer wearing a head-mounted virtual retinal display typically moves their eye as they look at images being displayed. According to the invention, the direction the viewer looks is tracked with the display. Prior to tracking, a map of the viewer's eye is generated by the display. The map includes 'landmarks' such as the viewer's optic nerve, fovea, and blood vessels. Thereafter, the relative position of one or more landmarks is used to track the viewing direction. The head-mounted display includes a light source and a scanner. The scanner deflects light received from the light source to scan a virtual image onto a viewer's retina in a periodic manner. During each scanning period, light is deflected along a prescribed pattern. To generate a map, and thereafter to monitor viewing direction, light reflected off the viewer's retina is monitored. Some of the reflected light travels back into the display device. The content of the reflected light will vary depending upon the image light projected and the features of the viewer's retina. During the initial mapping stage, the content of the image light can be fixed at a constant intensity, so that the content of the reflected light is related only to the feature's (i.e., landmarks) of the retina. The changing content of the reflected light is sampled at a sampling rate and stored. The scanner position at the time of each sample is used to correlate a position of the sample. The relative position and the content represent a map of the viewer's retina.

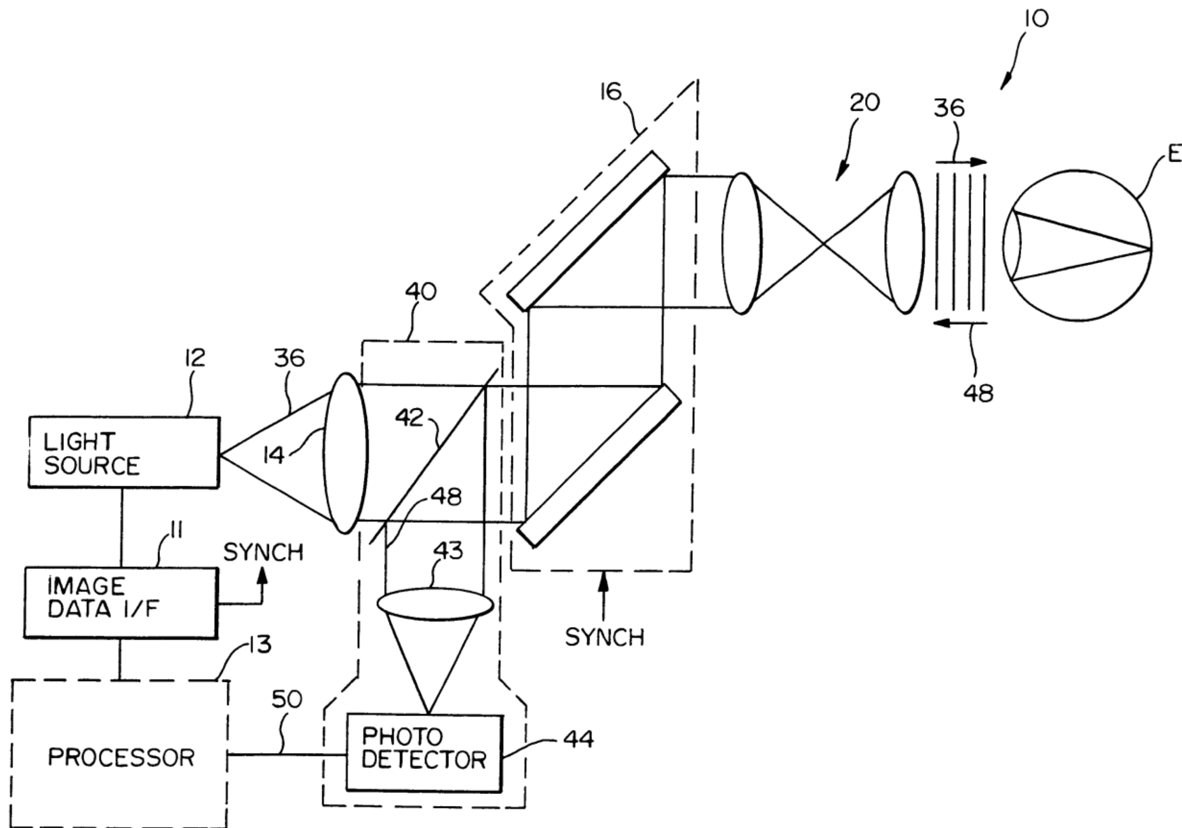


Fig. 17. Optical schematic diagram of a virtual retinal display having an eye tracking capability

According to one aspect of the invention, the light reflected from the viewer's eye travels back into an eyepiece and along a light path within the retinal display device. In a specific embodiment the reflected light is deflected by the scanner toward a beamsplitter. The beamsplitter deflects the reflected light toward a photodetector which samples the reflected light content. The beamsplitter is positioned between the light source and the scanner of the retinal display device.

For generating a virtual image, light emitted from the light source passes through the beamsplitter to the scanning subsystem and onward to the eyepiece and the viewer's eye. Light reflected from the viewer's eye passes back along the same path but is deflected so as not to return to the light source. Instead the light is deflected toward the photodetector. Thus, the beamsplitter passes light which is incident in one direction (e.g., light from the light source) and deflects light which is incident in the opposite direction (e.g., reflected light from the viewer's eye).

According to another aspect of the invention, a specific feature of the retina (e.g., fovea position) is monitored over time to track where the viewer is looking (i.e., the viewer's center of vision). The landmarks in the retina which correspond to such feature will cause the reflected light to exhibit an expected pattern. The relative position of such pattern in the reflected light will vary

according to the viewing direction. By identifying the pattern and correlating the relative orientation of the pattern to the orientation of the corresponding feature in the map, the change in viewing direction is determined. In various applications, such position indication is used as a pointing device or is used to determine image content. For example, as a pointing device the fovea position indicates pointer position. A blink of the eye for example, corresponds to actuating a pointing device (e.g., "clicking" a computer mouse.)

According to another aspect of the invention, the map of the viewer's retina is stored and used for purposes of viewer identification. In a security application for example, a viewer is denied access to information or denied operation of a computer or display when the viewer's retina does not correlate to a previously stored map of an authorized user.

According to an advantage of the invention, the display can track where a viewer is looking, use the viewer's eye as a pointer, and identify the person using the display. These and other aspects and advantages of the invention will be better understood by reference to the following detailed description taken in conjunction with the accompanying drawings.

4.3 Potential Advantages of the Virtual Retinal Display

It is really interesting to note why this family of imaging systems score better than the conventional display systems.

A) Brightness

One problem with conventional helmet mounted display image sources is the low luminance levels they produce. Most liquid crystal array image sources have insufficient luminance levels for operation in a see-through display. The VRD, however, does not contain individual Lambertian (or nearly Lambertian) pixel emitters (liquid crystal cells or phosphors) as do most LCD arrays and CRT's. The only light losses in the VRD result from the optics (including the scanners and fiber coupling optics). There is no inherent tradeoff, however, between resolution and luminance as is true with individual pixel emitters. In individual pixel emitters, a smaller physical size increases resolution but decreases luminance. In the Virtual Retinal Display, intensity of the beam entering the eye and resolution are independent of each other. Consequently, the VRD represents a major step away from the traditional limitations on display brightness.

B) Resolution

As resolution requirements increase, the number of picture elements must increase in a screen based display. These greater packing densities become increasingly difficult to manufacture successfully. The VRD overcomes this problem because the resolution of the display is limited only by the spot size on the retina. The spot size on the retina is determined primarily by the scanner speed, light modulation bandwidth, and imaging optics.

C) Yield

One limiting aspect in the manufacture of liquid crystal array image generators is the yield and reliability of the hundreds of thousands of individual liquid crystal cells present in these displays. For a liquid crystal array display to function properly at all times, each picture element must function properly. The Virtual Retinal Display requires only constant functionality from the light sources and the scanners. As resolution increases in virtual image displays, liquid crystal arrays will contain more and more individual liquid crystal cells. The Virtual Retinal Display will gain an increasing advantage over liquid crystal array image generators in terms of yield as resolution demands increase in the future.

D) Size

The theoretical size for horizontal and vertical scanners plus light sources for the VRD is smaller than the size of conventional liquid crystal array and CRT image sources. A typical size for a liquid crystal array image generator for helmet mounted display applications is one inch by one inch. The Mechanical Resonant Scanner used in this project was approximately 1 [cm] by 2m [cm]. Furthermore, the problem of scanner size has not been directly addressed. Further size reduction is certainly possible. It should be noted that light sources for a smaller, usable full color VRD must be much smaller than the sources used in this project. The potential size of light emitting diodes and diode lasers indicate that these sources show greatest promise for future systems in terms of size.

5. APPLICATIONS OF THE SCREENLESS DISPLAY

The main use of the screen less displays are used for the development of the mobile phones which are mainly used by the old and blind people as shown in figure 7. This type of the invention of the screen less displays was first done on the mobile phone named OWASYS 2CC. This model is very useful for the old, blind, and even for the people with less vision power.

Screen less displays technology is also implemented for the development of the screen less laptops. A laptop without an LCD can be a very useful portable solution when connected to CRT or fixed LCD monitors. Laptops without screens would also be a green solution, giving value to donated CRT monitors that would otherwise be heading for landfills. Portability means that volunteers, who don’t always have the time to travel to people’s homes, can more easily maintain this computer. Screenless displays are also widely applicable in the field of the holograms projection. Hologram projection is a result of a technological innovation that truly helps in touch less holographic interfaces. In fact, hologram projection projects 3D images of so high quality that it feels as if one can touch them. However, holographic projection is still to achieve mass acceptance as until now, conventional holograms, which offer 3D images.

Latest laser technology are also implementing the special technique of the screen less display through the presence of the several 3D scope animation or the screen provides the advantage of being combined with the Laser Valve Video Projector that helps in projecting video images by the use of the laser light instead of the Xenon Arc lamps as depicted in figure 8. Laser technologies have given an edge over the other technologies as the LVP gives the projector an excellent depth in the focus.

Screen less display's major working principle can also be implemented in the emerging of the new screen less TV's. Imagine that watching the TV picture that seems to be magically appearing in the thin air. The picture just floats on in front of the viewer; this would be a latest emerging technology in the future as depicted in figure 9.

6. ADVANTAGES AND DISADVANTAGES OF THE TECHNOLOGY

6.1 ADVANTAGES:

1. Low power requirements- Only six diodes are required and a few of a watts to deliver their images to the user's eyes [3].

2. Higher resolution images- The pixels in the images projected by the diodes can be made smaller than is possible with any CRT or flat panel display, so higher resolution can be achieved. With retinal projectors, the only limitation in the resolution of visual images will be the resolving power of the users' eyes.

3. Greater portability- The combination of diodes, lenses, and processing components in a retinal projector system will weigh only a few ounces.

4. Wider angle of view- Retinal projectors will be able to provide a wider field of view than is possible with display screens.

5. More accurate color- By modulating light sources to vary the intensity of red, green, and blue light, retinal projectors can provide a wider range of colors – and more fully saturated colors – than any other display technology.

6. Greater brightness and better contrast- Retinal projectors can provide higher levels of contrast and brightness than any other display system.

7. Ability to present 3D images- With their capability of presenting high definition image-pairs, retinal projectors can deliver the most highly realistic stereoscopic movies and still pictorial images to their users.

8. Ability to present far-point images- The human visual system is a far-point system. With today's desktop and laptop computers users must employ their near-point vision. The excessive use of our near-point vision in using computers, reading, sewing, playing video games, etc., is making myopia a very common impediment. The use of the far-point images that can be provided by retinal projector systems could reduce the incidence of myopia and, hence, the growing need for and use of eyeglasses.

9. Lower costs- The present cost of retinal projector systems is high. Nevertheless, there are no hard-to-overcome manufacturing problems in mass-producing and low-cost components, so inexpensive systems will soon become available. Environmental and disposal costs of these tiny delivery devices will also be minimal because toxic elements such as lead, phosphorus, arsenic, cadmium, and mercury are not used in their manufacture.

6.2 DISADVANTAGES:

1. The principle disadvantage is that Virtual retinal display (VRD) is not yet available in the significant number.
2. Prototypes and special experimental models are now being built, but their cost per unit is high.
3. The VRD technology is still under progress and Development.

7. FUTURE ENHANCEMENTS

For the future development of this emerging new technology, several researches are being conducted and the several renowned IT sector companies and other best labs present in the world are handling over the project of screenless displays.

Technology has become perhaps the greatest agent of change in the modern world. While never without risk, positive technological breakthroughs promise innovative solutions to the most pressing global challenges of our time, from resource scarcity to global environmental change. However, a lack of appropriate investment, outdated regulatory frameworks and gaps in public understanding prevent many promising technologies from achieving their potential.

This field saw rapid progress in 2013 and appears set for imminent breakthroughs of scalable deployment of screenless display. Various companies have made significant breakthroughs in the field, including virtual reality headsets, bionic contact lenses, the development of mobile phones for the elderly and partially blind people, and hologram-like videos without the need for moving parts or glasses.

- Microsoft in 2001 began the work on an idea for an Interactive table that mixes both the physical and the Virtual worlds.

- Multi touch is a human computer interaction technique and the hardwire devices that implement it, which allows users to compute without conventional input devices.

- CUBIT is being developed for the future use of the multi Touch use of the program.

 Development of the enhancement of the micro vision also gives the improved and the futuristic view of the screen less displays. This technology of the micro vision is the very well useful in the Artificial Retinal Display properties.

 Japanese scientists have invented the pair of intelligent Glasses that remembers where people last saw their keys, Handbags, iPod, and mobile phones.

 Smart Google is developing the compact video camera which films everything the wearer looks at the information what the viewer wants will be directly being seen in through the glasses where there is no screen or projector present

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 Several laboratories are working under progress on the electron beam lithography which includes the advanced enhancement of the futuristic screen less display.

 Adobe systems are also working out for the development and deployment cross platform of the several applications which are to be viewed without the actual screen.

8. CONCLUSION

The paper has elaborately discussed screenless displays which is one of the most emerging computer technologies and has become a new exciting rage for the upcoming generations as a field of the futuristic technology. Due to the ability of having several advantages which are involved in the making, designing, coding of the screenless, this needs plenty of knowledge and process for the development is still under the improvement. May be in the future the world may be dominated with the screen less display technologies and this enriches the world of technological empowerment in the field of the computer technology. Screenless displays promises the cost effective aspect and also brighter future in the computer technology.

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